phere, but as these losses, as well as the heat absorbed by the noncombustible portions, the air and fuel are unavoidable in the present state of science, they should be taken into account in making a practical test of fuel, and strict accuracy only requires that the loss be uniform and minimum in result. Practical experience teaches that almost perfect combustion may be attained in any of the common forms of steam generator by careful and regular stoking with a proper air supply; and, that the skill necessary to produce this result is possessed by many ordinary stokers, who have no knowledge of the laws which govern the combustion of fuels, will doubtless be admitted by many persons who have observed locomotive firemen or others, who are compelled to get a high rate of steam production. It is of course impossible to transfer all the heat produced in combustion to the water in a generator, because the gases cannot be reduced below the temperature of the water or steam within the generator, and a certain temperature above the atmosphere is necessary to produce draught in the chimney, but it is quite possible to so proportion the grate surface to the heating surface of the boiler that the gases will be reduced to a certain minimum temperature, and maintained at that temperature during a test. The temperature may be indicated by a pyrometer or high registering thermometer at the base of the chimney, and the rate of flow of the gases may be ascertained by the use of a draught gauge. Frequently an attempt is made to analyse the waste gases, this gives an uncertain result on account of the difficulty of getting representative samples of the gases, but from observation and examination of many tests the writer believes it unimportant, if the stoking and air regulation receive proper attention. The surface of the grate should be so proportioned to the heating, or heat absorbing surface of the generator that the gases will, when they reach the uptake, be reduced to say 400° Far.; the skilful firing and air regulation will produce practically perfect combustion, and uniform temperature. It is not of so much consequence either, as some people imagine, what kind of generator is used. The brick furnace is supposed to possess an advantage in maintaining the temperature necessary to perfect combustion, while contact with the cooler surface of a water lined furnace is supposed to prevent ignition of the volatile hydro-carbons coming from some fuels, producing carbonic oxide; but the writer is convinced that, by a proper regulation of the fire, so that the air will pass through and the gases pass over a bed of hot coals, or incandescent carbon, with frequent and even distribution of the fuel, as perfect combustion may be, and is, obtained in a water lined furnace as in a brick one. The water lined furnace avoids the radiation of heat and admission of air, both of which are an uncertain but certainly wasteful feature of the brick furnace. Steam boiler tests, although attended with some difficulty, are quite within the reach of ordinary consumers, and deserve to be better understood and used more than they are. In addition to their value as a method of determining the heating properties of fuel, they furnish the best possible means of ascertaining the condition and efficiency of the generator, and of checking, and if necessary correcting waste on the part of the stoker. It is desirable that such tests should be made frequently, because steam boilers are very liable to deteriorate and become wasteful, especially when set in brick, through the cracking of the brick walls, as well as by the coating of heating surfaces with scale or other deposits on the inner, and soot or ashes on the outer surfaces. It is quite practicable for steam users to have tests made by their engineers and ordinary assistants, but it is preferable to have an occasional test made by a professional engineer who has had experience in making such tests, as he will have gained special knowledge which will enable him to detect and locate imperfections in the generator more readily than those unaccustomed to such work. The writer would suggest to steam users the following practice: That one or more tests be made by an expert to determine the efficiency of the generator, and that he may direct any necessary repairs or corrections in the generator. After this has been done, and a standard of efficiency established, a good water meter should be inserted in the water supply pipe, so that a record of the water used may be continuously kept, and the stoker or engineer should keep a log and make daily reports of the coal consumed and the water evaporated. The meter readings will need correction, if absolute accuracy is desired, but for practical purposes this may not be necessary. It may seem like unnecessary labour and expense to weigh all the coal used, but a short trial will undoubtedly prove its value, as it will not only indicate, constantly, the condition of the generator, but to a certain extent, be a check upon the working of the engine and the amount of power used by the establishment, and it will furnish a constant incentive to the engineer, stoker, and those in charge of the steam machinery, to improve its working and reduce the amount of fuel consumption to its lowest limits. A general practice of this kind throughout the country would induce a rivalry in the saving of fuel, parallel to that found in marine practice, where it is claimed a horse power is produced by from one and a half to two pounds of fuel per hour, instead of four to ten pounds,—the last named quantity being not uncommon in ordinary steam plant, and would in course of a few years cause an enormous saving to the country, as well as to individual consumers. Rules governing the standard system of boiler trial, adopted by the American Society of Mechanical Engineers may be found in the transactions of that Society, vol. vi., 1884. The following simple instructions will enable any steam user to conduct a test of his boilers for the purpose of comparing the values of fuels, etc., after the efficiency of the generator has been established by a complete test by an expert, (observations of the quality of steam, strength of chimney draught and analysis of gases are omitted as they require special instruments and skilled manipulation).

INSTRUCTIONS FOR CONSUMERS' TEST.

A test to be of any value should be continued for not less than ten hours, and will require the constant attention of not less than four persons besides the regular attendants appointed as follows:—One or two men to weigh the coal, and one or two to attend to and weigh the water; one clerk to keep the log of the coal and water weighed, and one clerk to record the pressure of steam, temperature of feed water, temperature of chimney gases, and to keep a gross account of the coal and water as a check to the regular log.